Computerized Antimicrobial Decision Support for Hospitalized Patients with a Bloodstream Infection

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Abstract. We developed a computerized antimicrobial decision support program founded on our local bacterial susceptibility data. In a retrospective analysis of patients with a bloodstream infection, we compared the actual antimicrobials prescribed to the antimicrobials recommended by the program. We found the computer-guided therapy to be clinically and statistically more effective than the therapy initiated by the physicians. We conclude that computerized decision support can improve the targeting of empiric antimicrobial therapy.

Introduction. Initiation of ineffective empiric antimicrobial therapy is associated with an increased rate of mortality, yet unnecessary broad-spectrum antimicrobial therapy is also harmful to patients. We developed a computerized antimicrobial guidance program based on the last five years of our laboratory culture data and augmented by expert infectious disease logic. It is designed to assist physicians with the targeting of empiric antimicrobials for hospitalized patients by tracking bacteria and their evolving antimicrobial resistance profiles. The program uses case-matching techniques to determine potential pathogens and calculates effective antimicrobial therapy using the past antimicrobial susceptibility data from our laboratory. Costs, toxicities, and environmental impact of antimicrobial use also influence the final recommendations. In this analysis, we hypothesized that the computer program would provide a 10% improvement on the rate of effective empiric therapy provided for hospitalized patients with a bloodstream infection.

Methods. We enrolled all patients with a positive blood culture in our hospital during the first six months of 2002 and retrospectively determined the empiric therapy initiated within the 12 hours before and after the time of positive blood culture. Outpatients, patients with known pathogens, patients not treated with empiric antimicrobials, and those in whom the culture was determined a contaminant were excluded from further consideration. Antimicrobial recommendations from the microbiologic decision support tool were then determined by searching for cultures that matched specimen (blood), hospital unit, community- versus hospital-acquired category, age category, and gender. Antimicrobial recommendations were tailored to the patient allergies, age category, and presence of pregnancy, lactation, or hepatic impairment.

Results. The microbiology laboratory recorded 226 unique patient/pathogen blood cultures during the study period that met inclusion criteria. Physicians initiated effective empiric therapy in 150 out of the 226 events, for an effectiveness rate of 66%. The computer-guided therapy was effective in 195 of the 226 events for a rate of 86% (see figure). A contingency table analysis showed 55 cases where the computer recommendation was effective but the physicians' selection was not, and 8 cases where the physicians' antimicrobials were effective but the computer's was not ($p<0.0001$ by McNemar's test).

Discussion. For patients with a bloodstream infection, we found that our computer-guided statistically-derived antimicrobial therapy would potentially improve the rate of effectiveness of empirically chosen antimicrobials. Additionally, we have determined that the underlying methodology of the program is sound and that its safety and efficacy merit further development for hospital-wide use. We conclude that this computerized decision support program could enhance the current targeting of empiric antimicrobial therapy by tracking potential pathogens and their evolving antimicrobial resistance profiles.

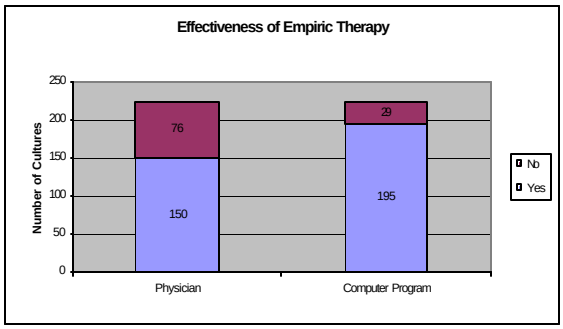

Figure. Chart comparing the rates of effectiveness of empiric therapy between physicians and the computer program.